

Protect flowable fill from freezing for 36 hours after placement.

### **600.3.06 Quality Acceptance**

#### **A. Jobsite Acceptance**

Acceptance of flowable fill is based on documentation as outlined in Subsection 500.1.03 of the Specifications and a minimum temperature of flowable fill at the point of delivery of 50 °F (10 °C).

### **600.3.07 Contractor Warranty and Maintenance**

General Provisions 101 through 150.

## **600.4 Measurement**

Flowable fill will be measured for payment in cubic yards (meters) in-place and accepted when shown as a pay item in the Contract. When flowable fill is not shown as a pay item, include the cost of the work in the bid price for the appropriate item.

### **600.4.01 Limits**

General Provisions 101 through 150.

## **600.5 Payment**

When shown as a pay item in the Contract, flowable fill complete, in-place and accepted will be paid for Per cubic yard (meter)

Payment will be made under:

Item No. 600	Flowable fill	Per cubic yard (meter)
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### **600.5.01 Adjustments**

General Provisions 101 through 150.

## **Section 602—Doublewal™ Precast Wall**

### **602.1 General Description**

This work includes the materials, manufacture, construction, measurement, and payment for Doublewal™ precast walls. The scope of work of the wall erection includes:

- Grading for wall construction
- Compacting the wall foundation (including areas underlying the footings and the precast modules)
- Dewatering (general and local) to execute the work properly
- Constructing footings
- Erecting precast concrete modules and caps
- Placing and compacting soils within the Doublewal™ modules
- Excavating and replacing unsuitable materials
- Constructing berms

Ensure that the architectural treatment of the modules is according to the Plan details.

#### **602.1.01 Definitions**

Doublewal™—Doublewal™ is a trademark.

#### **602.1.02 Related References**

##### **A. Standard Specifications**

Section 106—Control of Materials

Section 208—Embankments

Section 500—Concrete Structures

Section 573—Underdrains

Section 806—Aggregate for Drainage

Section 853—Reinforcement and Tensioning Steel

Section 865—Manufacture of Prestressed Concrete Bridge Members

Section 881—Fabrics

## **B. Referenced Documents**

GDT 35

AASHTO T 22

ASTM D 573

ASTM D 1752 Type II

## **602.1.03 Submittals**

### **A. Shop Drawings**

Submit Shop Drawings with each job to the Department for review and approval. The Shop Drawings shall be approved by the Department before beginning to fabricate the wall elements. Indicate on the Shop Drawings:

- General notes for constructing the wall
- Dimensions for the modules
- Fabrication tolerances
- Material requirements
- Reinforcing steel
- Module size markings that will agree with the wall designations on the construction Plans
- Project construction number, Prime Contractor, and wall designation in the title block in the lower right corner of the sheet
- Summary of quantities that indicate the cubic yards (meters) of concrete and pounds (kilograms) of reinforcing steel in each module and unit of parapet and footing

## **602.2 Materials**

### **A. Reinforcing Steel**

Ensure that reinforcing steel conforms to Section 853.

### **B. Concrete**

For precast modules and caps, use Class AAA concrete according to Section 500.

For footings, traffic barriers, and precast parapets use Class A cast-in-place concrete according to Section 500.

### **C. Joint Treatment**

Follow these joint treatment requirements:

1. Cover the joints with plastic filter fabric between the modules on the back side of the front face of the wall and on the inside of the back of the wall. Use fabric that meets the requirements of Subsection 881.2.05.  
In floodplains, use only woven fabric 3 ft (1 m) above and entirely below the 100-year flood elevations.
2. For bearing pads between the modules, use rubber pads that have a durometer hardness of 80+5. See Figure 1 (Figure 1 metric).
3. Place preformed cork that conforms to ASTM D 1752, Type II, adjacent to the key of transition modules as recommended by the Doublewal™ Corporation.

4. Ensure that the minimum width and lap of plastic filter fabric sheets are as follows:

Vertical joints	12 in (300 mm)
Horizontal joints	12 in (300 mm)
Laps in fabric	44 in (1.1 m)

#### D. Backfill

Use modular backfill materials within the rectangular cells of the Doublewal™ precast wall that meet the following requirements:

- Are free from organic or otherwise harmful material
- Conform to the following gradation limits:

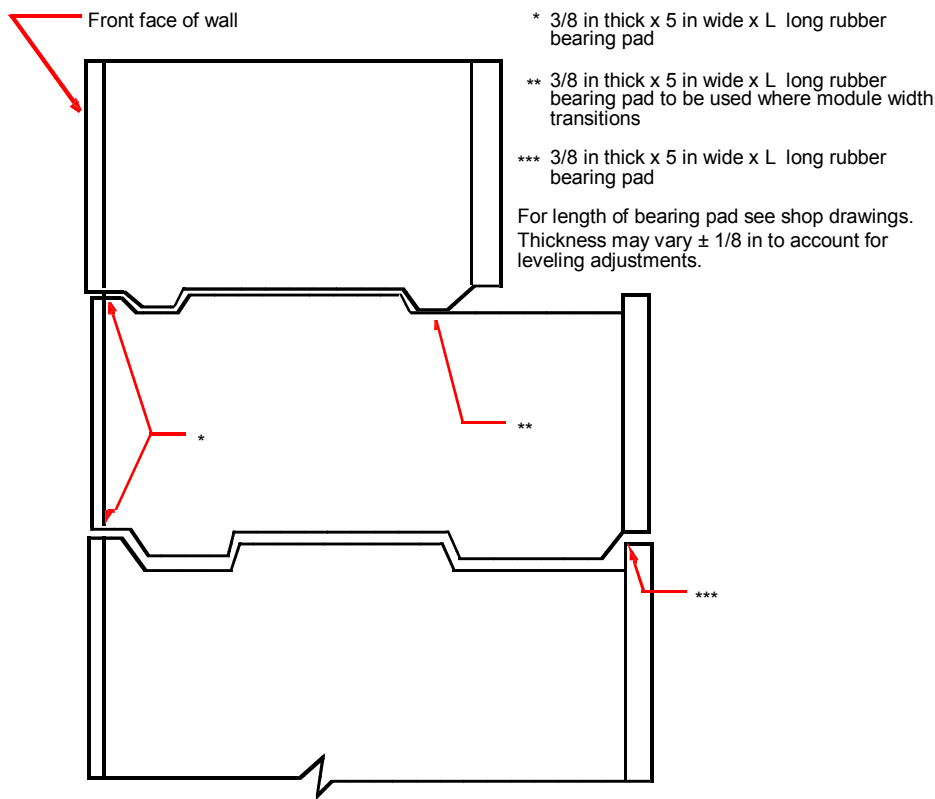
Sieve Size	Percent Passing
4 in (100 mm)	100
2 in (50 mm)	80 to 100
No. 10 (2.00 mm)	20 to 90
No. 200 (75 µm)	0 to 12

#### E. Drainage

Ensure that underdrain pipe meets the requirements of Subsection 573.2, “Materials.”

Ensure that filter fabric meets the requirements of Section 881.2.05.

Ensure that stone conforms to Subsection 806.2.01.



NOTE: Front face and rear face of modules shall be reinforced sufficiently to prevent cracking which might result from unequal distribution of bearing pressures. The reinforcing for the modules shall be as shown on the plans.

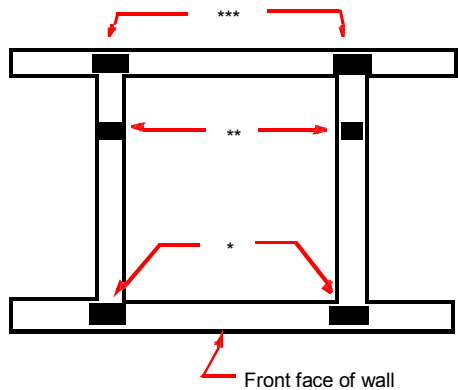
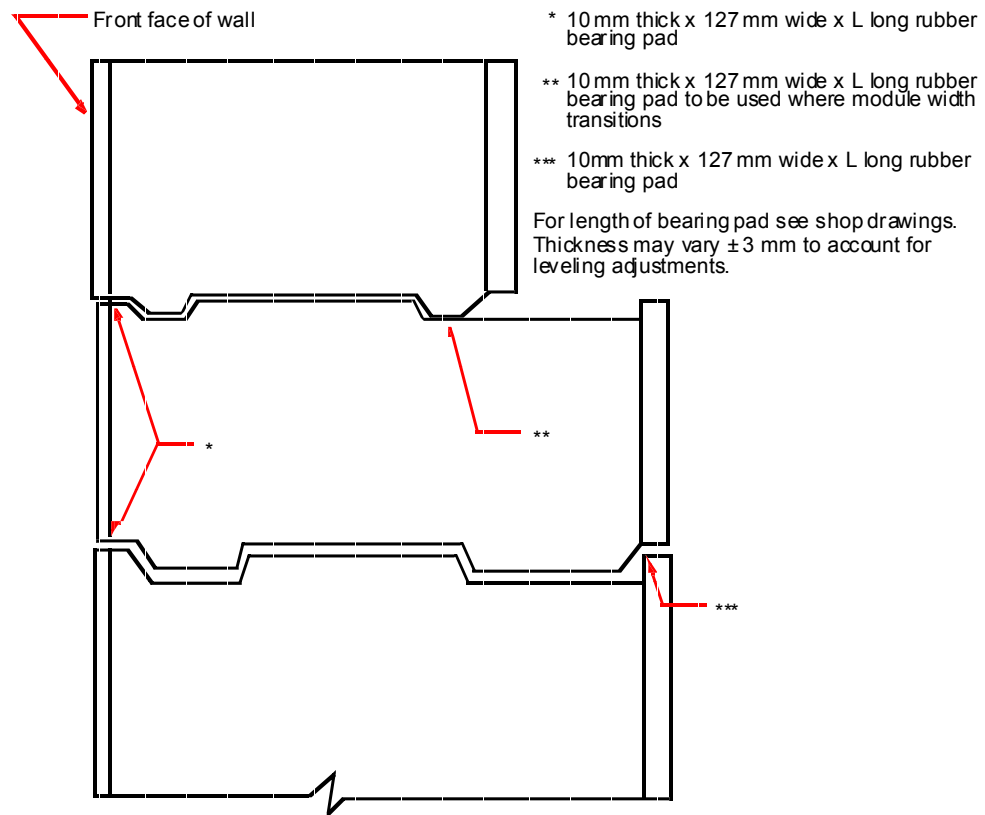


Figure 1



NOTE: Front face and rear face of modules shall be reinforced sufficiently to prevent cracking which might result from unequal distribution of bearing pressures. The reinforcing for the modules shall be as shown on the plans.

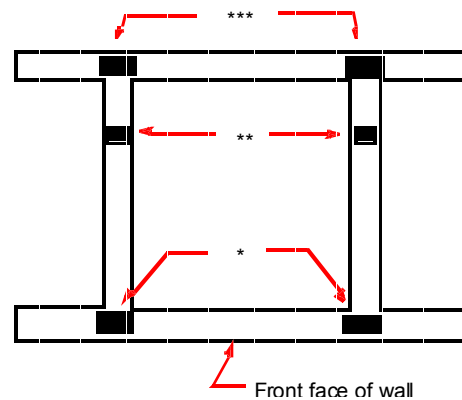


Figure 1 (metric)

**F. Certification**

Joint filler acceptance furnished for the work is based on Subsection 106.05, “Materials Certification.”

**G. Bearing Pads**

Use resilient, weather-resistant elastomer bearing pads. Use fiber reinforcement with rayon, nylon, and fiberglass or combinations of these fibers. The physical properties of the material are as follows:

- **Dimensions.** Ensure that dimensions are as detailed on the Plans. Various thicknesses may be required for leveling purposes.
- **Compression Modulus.** Ensure 1,200 psi (8 MPa) compression at less than 50 percent of the ultimate compressive strain. Determine compression on a 0.5 in (13 mm) specimen.
- **Shear Modulus.** Ensure 500 psi (3.5 MPa) in direct shear while compressed and 1,200 psi (8 MPa) at 50 percent ultimate shear strain uncompressed. Determine shear on a 0.5 in (13 mm) specimen.
- **Tensile Strength.** Ensure at least 400 psi (3 MPa) tested in transverse and longitudinal directions.
- **Property Retention.** Ensure heat aging at ASTM D 573 at 158 °F (70 °C) for 72 hours. Ensure change in tensile strength does not exceed 25 percent. Ensure change in elongation does not exceed 25 percent. Ensure no creep failure when stressed to the above maximum requirements for long periods.

Have the above properties certified according to Subsection 106.05, “Materials Certification.”

**602.2.01 Delivery, Storage, and Handling**

Safely handle, store, and ship modules and prevent damage to the module.

**602.3 Construction Requirements****602.3.01 Personnel**

The Contractor shall have Doublewal™, or its licensee, provide an Erection Supervisor who is thoroughly familiar with the Doublewal™ erection technique to assist the Contractor in erecting the Doublewal™ and verify that the Doublewal™ is erected properly.

**602.3.02 Equipment**

General Provisions 101 through 150.

**602.3.03 Preparation**

Make arrangements to obtain precast concrete modules and caps, joint materials, and the expertise to construct the Doublewal™ precast wall.

**602.3.04 Fabrication****A. Reinforcing Steel**

Have the reinforcing steel for precast modules and other components shop fabricated according to the requirements of the Doublewal™ Corporation.

**B. Precast Concrete****1. Casting**

Perform casting according to the requirements of the Doublewal™ Corporation.

- a. Place the concrete in each unit without significant interruption.
- b. Consolidate the concrete by using an approved internal vibrator and external vibrators that are securely attached to the steel form.

**2. Curing**

Cure the units as specified in Subsection 865.2.01.B.10 and long enough for the concrete to develop the specified compressive strength.

**3. Removing the Forms**

Keep the forms in place until they can be removed without damaging the unit.

#### 4. Concrete Finish and Tolerances

Cast concrete surfaces for the front face against steel forms or architectural form liners if noted on the Plans. Ensure that the units are manufactured within the following tolerances:

- a. Keep all dimensions within 3/16 in (5 mm).
- b. Keep deviation from the square measured on the diagonal to 5/16 in. (8 mm).
- c. Finish the bearing surfaces (top of the module's front panel and back panel) to within 1/8 in (3 mm) when measuring with a 8 ft (2.4 m) straightedge.
- d. Meet exposed surface tolerances as follows:
  - 1) **Smooth Finish.** Correct variations greater than 0.1 in (2.5 mm) when tested with a 5 ft (1.5 m) straightedge before moving the panel from the casting yard.
  - 2) **Other Finish Types.** Ensure that other finish types conform to approved samples displayed by the manufacturer.

#### 5. Compressive Strength

Perform compression tests to determine the minimum strength requirements on cylinders.

- a. Make at least three cylinders to determine when the units may be put into service from each day's production.
- b. Cure the cylinders according to GDT 35.D.B.6.
- c. Ensure that the shipping strength is equal to the required 28-day strength.
- d. Make an additional 2 cylinders to determine 28-day strength for each day's production or for each 50 yd<sup>3</sup> (40 m<sup>3</sup>) of concrete placed, whichever amount of concrete is less.  
Cure according to GDT 35.D.B.6.
- e. Ensure that the 28-day compressive strength is at least 5,000 psi (35 MPa).
- f. Perform compressive strength tests according to AASHTO T 22.  
If the cylinder tests are questionable, take cores from modules at the manufacturer's option and expense and use them to determine the 28-day strength.

#### 6. Testing and Inspection

Determine the acceptability of the precast units at the casting yard by performing compression tests and visually inspecting them during and after casting. Ensure the units conform with the Specifications and drawings.

The precast units are acceptable, regardless of curing age, when compression test results show that the strength will conform to 28-day Specifications and all other requirements.

Instruct the manufacturer to furnish the facilities and assistance to perform sampling and testing rapidly and satisfactorily.

#### 7. Marking

Mark each unit according to the requirements of the Office of Materials and Research.

#### 8. Repairs at the Plant

Before shipment, concrete technical service personnel from the OMR and/or the plant's certified personnel shall examine the surfaces of precast units for approval.

The Engineer will inspect the surfaces at the job site. Patch honeycombing and other defects in the wall surfaces to the Engineer's satisfaction.

#### 9. Rejection

Units will be rejected if they do not meet the requirements in Subsection 602.3.04.B.4, "Concrete Finish and Tolerances," Subsection 602.3.04.B.5, "Compressive Strength," and any of the above paragraphs.

Units that are cracked or damaged, or do not meet tolerance requirements in this Specification will not be allowed on the job site.

### 602.3.05 Construction

#### A. Foundation Bed

Excavate and compact the foundation bed for the Doublewall™ precast wall as required in this Specification. Obtain the Engineer's approval before beginning the erection.

**B. Foundation**

Cast the footings in place to the dimensions and details shown on the project Plans. Construct the footings with or without forms. Strictly follow the top of footing elevations shown on the Plans.

Before erecting the wall, compact the foundation area to at least 95 percent of maximum laboratory dry density specified in Subsection 208.3.05.B.2.c.

**C. Wall Erection**

Install the precast concrete module units according to the manufacturer's recommendations as shown on the approved shop drawings.

1. Set the bottom course of units to true line and grade. Grade the foundation for the wall level with a width equal to the width of the lower course unit.
2. Remove and replace foundation soils that cannot sustain the required compaction as provided in this Specification.
3. When placing the modules on the footing, do not vary from level the horizontal levelness from one module to another (measured on the top of the module's front face and back face), by more than 1/8 in (3 mm). Measure with a 10 ft (3 m) straightedge and level.
4. Maintain this tolerance when placing additional layers of modules on the existing layer.
5. If leveling is required, use various thickness of bearing pads to level the module. Place these pads on the beam bearing pads. Do not allow the total thickness of the rubber bearing pads to exceed 0.75 in. (20 mm).
6. Interlock the modular units above the first course with lower courses. Stagger vertical joints with each successive course.
7. Ensure that the vertical joint opening on the front face of the wall does not exceed 0.75 in (20 mm). Install joint treatment in the horizontal joints of both faces as in Subsection 602.2.C, "Joint Treatment."
8. Ensure that the tolerances and alignment are according to the Department's Specifications for concrete structures.
  - Vertical tolerances (plumbness) and horizontal alignment tolerances shall not exceed 3/8 in (10 mm) when measured along a 8 ft (2.4 m) straightedge.
  - Overall wall vertical tolerance (plumbness from top to bottom) shall not exceed 0.5 in per 8 ft (5 mm/m) of wall height, except for battered wall designs. In this case, the variation of the battered plane from the theoretical shall not exceed 0.5 in per 8 ft (5 mm/m) of wall.
  - The footing surface shall not vary from level more than 1/8 in per 10 ft. (1 mm/m).
9. If repairs at the job site are necessary, have experienced personnel use methods and materials recommended by the manufacturer.  
 Perform patching only when the repaired area will conform to the balance of the work in appearance, strength, and durability. Repair to the Engineer's satisfaction.

**D. Modular Backfill Materials**

Backfill each successive course of modular units.

1. Fill the rectangular cells of the Doublewal™ precast walls directly below the edge of the travelway with modular backfill material in two lifts or layers.
  - a. Compact each layer to 95 percent of the maximum laboratory dry density.
  - b. Fill the cells beyond step a above in one lift or layer and compact to 90 percent of the maximum laboratory dry density.
2. Place modular backfill material and embankment around the outside of the wall according to Section 208.
3. When erecting a wall, backfill behind the wall immediately after erecting successive courses of units. Do not allow the modular backfill material and the top of the last erected course to differ in elevation by more than 6 ft. (1.8 m).
4. Place the underdrain, if required, according to the Plans and Specifications. Include underdrain costs in the modular backfill material cost.
5. Ensure that the modular backfill material at bridge structures, and extending for 100 ft (30 m) from the lateral limits of the bridge, contains fines to fill the voids in the aggregate. Compact the aggregate material to at least 95 percent of the maximum laboratory dry density.
6. Place the modular backfill material in two lifts.

**E. Storm Drains**

Cast the appropriate storm drainage into wall modules at the elevation and locations indicated on drainage profiles. Construct the catch basin and place the storm drain in coordination with construction of the Doublewal™ precast wall.

**F. Dewatering**

Furnish, install, operate, and maintain dewatering systems as necessary to:

- Keep the site dry and workable
- Grade and compact the wall foundation
- Erect and backfill the wall

Ensure that these systems include equipment and materials and are continued as long as necessary. Include dewatering costs in the price bid for modular backfill material.

**602.3.06 Quality Acceptance**

General Provisions 101 through 150.

**602.3.07 Contractor Warranty and Maintenance**

General Provisions 101 through 150.

**602.4 Measurement**

When a Doublewal™ precast wall is built to plan dimensions, the Plan quantities will be the pay quantities. When the Engineer changes the Plan dimensions during construction or when original Plans are in error, the revised Plan quantities will be the pay quantities.

**A. Excavation and Shoring**

Excavation, including removing unstable material and shoring to construct a Doublewal™ precast wall will not be measured and paid for separately.

**B. Modules**

The area of modules, complete in place and accepted, are designated for payment by the surface area per square foot (meter) of the front face of each module width. The front face of the wall is the face exposed to view.

**C. Modular Backfill Material**

The modular backfill material used in the modules is designated for payment by the cubic yard (meter), complete in place.

Modular backfill material that extends beyond the width and height of modules is incidental. The cost will be included in the price bid for Contract Items.

Increases in foundation excavation from undercut ordered by the Engineer that requires modular backfill material to provide stability will be measured and paid for at the Contract Unit Price per cubic yard (meter) of modular backfill material.

Backfilling undercut areas with materials of grades at or lower than common excavation soils will not be measured or paid for separately.

**D. Concrete Footing**

The concrete footings will be measured for payment by the cubic yard (meter). This measurement includes steps and reinforcing steel indicated on the Plans.

**E. Precast Barriers and Parapets**

The following Units, complete in place and accepted, will be designated on the Plans and measured and paid for at the Contract Unit Price bid per yard (meter) for each type Unit.

- Precast parapet A
- Precast parapet B
- Cast-in-place coping
- Cast-in-place traffic barrier A

## 602.4.01

- Cast-in-place traffic barrier B
- Precast traffic barrier B

This measurement also includes cast-in-place concrete and reinforcing steel to install the precast units as shown on the Plans.

Use precast parapet B and cast-in-place traffic barrier B, or use precast traffic barrier B, whenever noise walls, light standards, or other appurtenances are mounted on top of the traffic barrier or parapet. Use precast parapet A and cast-in-place traffic barrier A, or use precast traffic barrier B when no appurtenance is used on top of the parapet or traffic barrier.

### 602.4.01 Limits

General Provisions 101 through 150.

## 602.5 Payment

When the wall is built to Plan dimensions, the Plan quantities will be the pay quantities. When plan dimensions are revised as directed by the Engineer, the wall will be paid for using the revised Plan quantities. Payment is full compensation for fabricating, transporting, and erecting materials according to the Plans and Specifications.

No separate measurement or payment will be made for tools, supervision, labor, coatings, joint materials (including but not limited to cork, rubber pads, and filter fabric), site preparation, or other incidentals to perform the work.

The following items, when shown on the Plans, will be paid for according to the applicable sections of the Project Specifications:

- Concrete side barrier
- Sound barriers
- Light standards
- V gutters
- Guard rail
- Fencing
- Handrail

Sleeves for chain link fencing and anchor bolts for light standards and noise barriers, when installed on the wall shall be included in the price bid for wall items.

Modifications to accommodate drainage systems are incidental and shall be included in the price bid for wall items.

Payment will be made under:

Item No. 602	Modules—(width)	Per square foot (meter)
Item No. 602	Modular backfill material	Per cubic yard (meter)
Item No. 602	Concrete footing	Per cubic yard (meter)
Item No. 602	Precast parapet A	Per linear foot (meter)
Item No. 602	Precast parapet B	Per linear foot (meter)
Item No. 602	Cast-in-place traffic barrier A	Per linear foot (meter)
Item No. 602	Cast-in-place traffic barrier B	Per linear foot (meter)
Item No. 602	Cast-in-place coping	Per linear foot (meter)
Item No. 602	Precast traffic barrier B	Per linear foot (meter)

### 602.5.01 Adjustments

General Provisions 101 through 150.